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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

Ex parte DAVID SMITH, HELEN LIU, TIM DENNIS, JANE MANNING, HSIN-CHIAO LUAN, ANN WALDHAUER, GENEVIEVE A. SOLOMON, BRENDA PAGULAYAN MALGAPU, and JOSEPH RAMIREZ

Appeal 2016-002254
Application 12/890,428
Technology Center 1700

Before MICHAEL P. COLAIANNI, JENNIFER R. GUPTA, AND LILAN REN, *Administrative Patent Judges*.

GUPTA, *Administrative Patent Judge*.

DECISION ON APPEAL[1]

Appellants[2] appeal under 35 U.S.C. § 134(a) from the Examiner's decision finally rejecting claims 1, 2, 7, 8, and 23–26. We have jurisdiction under 35 U.S.C. § 6(b). We affirm.

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[1] In this decision, we refer to Appellants' Specification filed September 24, 2010 ("Spec."), the Final Office Action mailed November 17, 2014 ("Final Act."), the Appeal Brief filed April 16, 2015 ("App. Br."), and the Examiner's Answer mailed October 19, 2015 ("Ans.").

[2] Appellants identify the real party in interest as SunPower Corporation. App. Br. 3.

The claims are directed to a method of fabricating an emitter region of a solar cell. Claim 1, reproduced below, is illustrative of the claims on appeal.

> 1. A method of fabricating an emitter region of a solar cell, the method comprising:
>
> forming, in a furnace, a tunnel oxide layer on a surface of a substrate, the forming comprising heating the substrate in the furnace at a temperature of approximately, 900 degrees Celsius at a pressure of approximately 500 mTorr for approximately 3 minutes in an atmosphere of oxygen to provide the tunnel oxide layer having a thickness of approximately 1.5 nanometers; and, without removing the substrate from the furnace,
>
> forming an amorphous layer on the tunnel oxide layer;
>
> doping the amorphous layer to provide a first region comprising N-type dopants and a second region comprising P-type dopants; and, subsequently,
>
> heating the amorphous layer to provide a polycrystalline layer comprising an N-type-doped region and a P-type-doped region.

App. Br. 11 (Appendix A: Claims).

Independent claim 24 recites a method of fabricating an emitter region of a solar cell similar to claim 1. *See id.* at 12–13.

Appellants argue the claims as a group, of which claim 1 above is representative. *See id.* at 6–9. Appellants have not presented separate arguments specifically directed to independent claim 24 or the dependent claims under rejection. *Id.* As a consequence, dependent claims 2, 7, 8, 23, 25, and 26 will stand or fall with their parent independent claims as represented by claim 1.

DISCUSSION

Appellants request review of the rejection of claims 1, 2, 7, 8, and 23–26 under 35 U.S.C. § 103(a) as unpatentable over Swanson (US 7,468,485 B1, issued December 23, 2008) (hereinafter "Swanson") in view of Bergemont et al. (US 5,566,044, issued October 15, 1996) (hereinafter "Bergemont"), Hatalis et al., "Large grain polycrystalline silicon by low temperature annealing of low pressure chemical vapor deposited amorphous silicon films," 63 *J. Appl. Phys.* 2260–2266 (1988) (hereinafter "Hatalis"), Green et al., "Understanding the Limits of Ultrathin SiO_2 and Si-O-N Gate Dielectrics for Sub-50 nm CMOS," 48 Microelectronic Engineering 25–30 (1999) (hereinafter "Green"), and Bierhals et al., "Improved understanding of thermally activated structural changes in Al/SiOx/p-Si tunnel diodes by means of infrared spectroscopy," 83 *J. Appl. Phys.* 1371–1378 (1998) (hereinafter "Bierhals") from the Examiner's Final Office Action. Final Act. 3–13; Ans. 3.

We review the appealed rejections for error based upon the issues identified by appellants and in light of the arguments and evidence produced thereon. *Cf. Ex parte Frye*, 94 USPQ2d 1072, 1075 (BPAI 2010) (precedential) (cited with approval in *In re Jung*, 637 F.3d 1356, 1365 (Fed. Cir. 2011) ("it has long been the Board's practice to require an applicant to identify the alleged error in the examiner's rejections")). After considering the evidence presented in this Appeal and each of Appellants' contentions, we are not persuaded that Appellants identify reversible error. Thus, we affirm the Examiner's rejections for the reasons expressed in the Final Office Action, the Answer, and below.

The Examiner finds, and Appellants do not dispute that, Swanson discloses a method of fabricating an emitter region of a solar cell that includes forming a tunnel oxide on the surface of a substrate by ozone bath oxidation or another means, forming a polysilicon layer on the tunnel oxide, and doping the polysilicon layer to provide a second p-type region and a first n-type region, but fails to teach the tunnel oxide formed in a furnace by oxidation, and forming an amorphous silicon layer on the tunnel oxide layer as required by claim 1. Final Act. 4 (citing Swanson 3:35–67, 4:1–15, and 4:55–67). The Examiner finds, and Appellants do not dispute that, it was well-known, as evidenced by Bergemont, to form a tunnel oxide layer using thermal oxidation in the same furnace or reaction chamber used to subsequently deposit a silicon layer using vapor deposition. *See* Final Act. 4 (citing Bergemont 4:40–48); *see also* Ans. 13. The Examiner determines that one of ordinary skill in the art would have been motivated to perform thermal oxidation in the same process chamber or furnace used to subsequently deposit a silicon layer, as taught by Bergemont, to form the tunnel oxide layer in Swanson's solar cell, and the results would have been predictable. Final Act. 4; Ans. 13.

The Examiner acknowledges that the Swanson's method, as modified by Bergemont, fails to teach or suggest the temperature or pressure conditions of the thermal oxidation step to form the tunnel oxide. Final Act. 6. The Examiner, however, finds that temperature, pressure, and time affect the growth rate and final thickness of the tunnel oxide, as evidenced by Green and Beirhals, and thus are result-effective variables. Final Act. 6 (citing Green 26 (¶ 2) – 27 (¶ 3); Fig. 4, and Beirhals 1371 (¶ 1) and 1372 (¶¶ 3–4); Ans. 14. The Examiner determines that it would have been within

the skill of the ordinary artisan to "optimize the time, temperature, and pressure of the oxidation step for growing the tunnel oxide within the scope of the present claims so as to produce desired end results." Final Act. 7.

Appellants argue that

> Swanson does not disclose that its' process for forming a tunnel oxide layer, using an ozone bath, which is a wet chemical process, "could be replaced with a . . . fabrication that requires . . . (1) [forming] . . . a thermal oxide [layer] in a furnace (which is a dry growth process), (2) [forming the tunnel oxide layer] in the same furnace as used to deposit a silicon layer, and (3) [forming the tunnel oxide layer] in the same surface used to subsequently form a silicon layer without removing the substrate [from the furnace."]

App. Br. 8 (emphasis omitted). Appellants further argue that "there is no indication in Bergemont . . . that the [disclosure] of Bergemont . . . could be understood to somehow be applied as a substitute for the process of Swanson. *Id.*

Appellants' arguments are not persuasive of reversible error in the Examiner's rejection. Appellants do not dispute the Examiner's findings with respect to Swanson or Bergemont individually. *See* App. Br. 6–9. A preponderance of the evidence supports the Examiner's reason to combine Swanson and Bergemont because the proposed combination is nothing more than the predictable use of prior art elements according to their established functions. *See KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 417 (2007) (In assessing the obviousness of claims to a combination of prior art elements, the question to be asked is "whether the improvement is more than the predictable use of prior art elements according to their established functions."). Appellants have not identified an error in the Examiner's reasoning and we find none.

Appellants argue that "[t]here is no indication in Green of any applicability to the solar industry." App. Br. 8. Appellants also argue "there is no indication that the processing parameters of Green and Bierhals could even be combined to suggest processing parameters for a tunnel dielectric for a solar cell." *Id.* at 8–9. Appellants further argue that "even upon combining the disclosures of Green and Bierhals . . . the [] claimed feature would not be achieved." *Id.* at 8.

Appellants' arguments are not persuasive of reversible error in the Examiner's rejection. "A recognition in the prior art that a property is affected by the variable is sufficient to find the variable result-effective." *In re Applied Materials, Inc.*, 692 F.3d 1289, 1297 (Fed. Cir. 2012). The portions of Green and Bierhals cited by the Examiner reasonably support the finding that the temperature and pressure of the furnace used for forming the tunnel oxide layer (e.g., a silicon oxide layer), as well as the time of growth of the tunnel oxide layer in the furnace, are result effective variables. Final Act. 6–7; Ans. 14. Appellants neither contest this finding or present sufficient evidence that the claimed parameters for forming the tunnel oxide layer—temperature and pressure of the furnace and the time of growth of the tunnel oxide layer in the furnace—are critical, for example by showing that the parameters achieve unexpected results. *In re Aller*, 220 F.2d 454, 456 (CCPA 1955). In fact, as the Examiner points out, Appellants' Specification discloses that a tunnel oxide layer having a thickness of approximately 1.5 nanometers may be formed in a furnace heated at a temperature of approximately 565 degrees Celsius, at a pressure of approximately 300 Torr, for approximately 60 minutes in an atmosphere of oxygen. Spec. ¶ 25; Ans. 14. This disclosure is evidence that the claimed parameters at which

the furnace is operated (temperature, pressure, and time) are not critical and do not produce any new or unexpected result. *See Applied Materials*, 692 F.3d at 1297 ("The outcome of optimizing a result-effective variable may still be patentable if the claimed ranges are 'critical' and 'produce a new and unexpected result which is different in kind and not merely in degree from the results of the prior art."' (internal citations omitted)).

For the reasons stated in the Final Action, Answer, and above, Appellants fail to identify a reversible error in the § 103 rejection of claims 1, 2, 7, 8, and 23–26.

DECISION

For the above reasons, the Examiner's rejection of claims 1, 2, 7, 8, and 23–26 is affirmed.

No time period for taking any subsequent action in connection with this appeal may be extended under 37 C.F.R. § 1.136(a).

AFFIRMED